

FORM PTO-1390 (Modified) (REV 11-2000)		U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE		ATTORNEY'S DOCKET NUMBER 4006-007-30	
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371				U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR 10/070918)	
INTERNATIONAL APPLICATION NO. PCT/BE98/00180		INTERNATIONAL FILING DATE 20 NOVEMBER 1998		PRIORITY DATE CLAIMED 20 NOVEMBER 1997	
TITLE OF INVENTION PROCESS AND PLANT FOR SEPARATING THE CONSTITUENTS OF WORN TYRES					
APPLICANT(S) FOR DO/EO/US DEBAILLEUL, Gerard					

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)). The submission must include items (5), (6), (9) and (24) indicated below.
4. ☒ The US has been elected by the expiration of 19 months from the priority date (Article 31).
5. ☒ A copy of the International Application as filed (35 U.S.C. 371 (c) (2))
 - a. ☐ is attached hereto (required only if not communicated by the International Bureau).
 - b. ☒ has been communicated by the International Bureau.
 - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ An English language translation of the International Application as filed (35 U.S.C. 371(c)(2)).
 - a. ☒ is attached hereto.
 - b. ☐ has been previously submitted under 35 U.S.C. 154(d)(4).
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))
 - a. ☐ are attached hereto (required only if not communicated by the International Bureau).
 - b. ☒ have been communicated by the International Bureau.
 - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
 - d. ☐ have not been made and will not be made.
8. ☐ An English language translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
10. ☒ An English language translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).
11. ☐ A copy of the International Preliminary Examination Report (PCT/IPEA/409).
12. ☐ A copy of the International Search Report (PCT/ISA/210).

Items 13 to 20 below concern document(s) or information included:

13. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
14. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
15. ☒ A **FIRST** preliminary amendment.
16. ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
17. ☐ A substitute specification.
18. ☐ A change of power of attorney and/or address letter.
19. ☐ A computer-readable form of the sequence listing in accordance with PCT Rule 13ter.2 and 35 U.S.C. 1.821 - 1.825.
20. ☐ A second copy of the published international application under 35 U.S.C. 154(d)(4).
21. ☐ A second copy of the English language translation of the international application under 35 U.S.C. 154(d)(4).
22. ☐ Certificate of Mailing by Express Mail
23. ☒ Other items or information:
 Copy of the international application as published (WO 99/27004)
 English translation of the International Preliminary Examination Report
 Change of Address

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR 1.53) 107070918		INTERNATIONAL APPLICATION NO. PCT/BE98/00180		ATTORNEY'S DOCKET NUMBER 4006-007-30	
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24. The following fees are submitted: BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) : <input type="checkbox"/> Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO \$1040.00 <input checked="" type="checkbox"/> International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO \$890.00 <input type="checkbox"/> International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO \$740.00 <input type="checkbox"/> International preliminary examination fee (37 CFR 1.482) paid to USPTO but all claims did not satisfy provisions of PCT Article 33(1)-(4) \$710.00 <input type="checkbox"/> International preliminary examination fee (37 CFR 1.482) paid to USPTO and all claims satisfied provisions of PCT Article 33(1)-(4) \$100.00 <div style="text-align: right;">ENTER APPROPRIATE BASIC FEE AMOUNT =</div>				CALCULATIONS PTO USE ONLY	
				\$890.00	
Surcharge of \$130.00 for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492 (e)).				\$0.00	
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	15 - 20 =	0	x \$18.00	\$0.00	
Independent claims	1 - 3 =	0	x \$84.00	\$0.00	
Multiple Dependent Claims (check if applicable). <input type="checkbox"/>				\$0.00	
TOTAL OF ABOVE CALCULATIONS =				\$890.00	
<input checked="" type="checkbox"/> Applicant claims small entity status. See 37 CFR 1.27). The fees indicated above are reduced by 1/2.				\$445.00	
SUBTOTAL =				\$445.00	
Processing fee of \$130.00 for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492 (f)).				\$0.00	
TOTAL NATIONAL FEE =				\$445.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) (check if applicable). <input type="checkbox"/>				\$0.00	
TOTAL FEES ENCLOSED =				\$445.00	
				Amount to be: refunded	\$
				charged	\$

a. <input checked="" type="checkbox"/> A check in the amount of <u> \$445.00 </u> to cover the above fees is enclosed. b. <input type="checkbox"/> Please charge my Deposit Account No. _____ in the amount of _____ to cover the above fees. A duplicate copy of this sheet is enclosed. c. <input checked="" type="checkbox"/> The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. <u> 50-1442 </u> . A duplicate copy of this sheet is enclosed. d. <input type="checkbox"/> Fees are to be charged to a credit card. WARNING: Information on this form may become public. Credit card information should not be included on this form. Provide credit card information and authorization on PTO-2038.	<div style="border: 1px solid black; padding: 5px; min-height: 150px;"> NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status. SEND ALL CORRESPONDENCE TO: Supervisor, Patent Prosecution Services PIPER MARBURY RUDNICK & WOLFE, LLP 1200 Nineteenth Street, NW Washington, DC 20036-2412 US </div>
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SIGNATURE SCHNEIDER, Jerold I. NAME 24,765 REGISTRATION NUMBER 13 MARCH 2002 DATE	
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Rec'd PCT/PTO 20 AUG 2002

DOCKET NO. 4006-007-30

PATENT COOPERATION TREATY (PCT)

IN THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US)

In re Application of: DEBAILLEUL, Gérard
Int'l Application No.: PCT/BE98/00180
Int'l Filing Date: 20 NOVEMBER 1998
Priority Date: 20 NOVEMBER 1997
U.S. Application No.: 10/070,918
For: PROCESS AND PLANT FOR SEPARATING THE
CONSTITUENTS OF WORN TYRES

SUBSTITUTE
PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Box PCT
Washington, D.C. 20231

SIR:

Please disregard the preliminary amendment filed March 13, 2002 in the above-identified application. This amendment replaces that earlier filed preliminary amendment. Prior to any examination on the merits, and with reference to the accompanying English translation, please amend this application as follows:

IN THE SPECIFICATION

Page 1, before the first paragraph and below the Title, insert the following section, including a section heading:

- - CROSS REFERENCE TO RELATED APPLICATIONS

This application is the U.S. National Stage of International Application No.

PCT/BE98/00180 filed 20 November 1998, and Belgian Application No. 9700933

filed 20 November 1997. The entirety of each of those applications is incorporated herein by reference.

BACKGROUND OF THE INVENTION - -.

Delete the first paragraph, at page 1, lines 3-8, and insert therefor the following:

--The present invention relates to a process and a plant for the treatment of vulcanized rubber of all kinds, such as tyres, conveyor belts, boots, shoes and other objects containing assembled rubber and polymer materials for the purpose of recycling the components by the relevant industries.--.

Delete the fourth paragraph at page 2, lines 25-32, and insert therefor the following:

--GB 2,026,144 (1979) discloses a plant for the treatment of rubber waste and of synthetic materials coming from worn tyres. Thermal decomposition of the product, which is coarsely reduced, is carried out in a fluidized bed of sand at 800°C in the presence of oxygen. The gases produced by the decomposition are used and, at the end of the process, the reinforcing metals are recovered by means of magnets.--.

Page 3, between lines 18 and 19, insert the following section heading:

--SUMMARY OF THE INVENTION--.

Delete the first full paragraph, at page 4, lines 5-9, and insert therefor the following:

--B) The reduced waste is introduced into a reactor and treated for 30 minutes at 350°C with an OH⁻ ion generator, preferably a strong alkaline base such as molten NaOH. 3. Separation of the basic liquid and the residues coming from the treated rubber.--.

Page 4, between lines 32 and 33, insert the following section heading:

- - BRIEF DESCRIPTION OF THE DRAWINGS - -.

Page 5, between lines 7 and 8, insert the following section heading:

-- DETAILED DESCRIPTION --.

Delete the first full paragraph at page 5, lines 8-27, and insert therefor the following:

--As shown in Figure 1, crystallized NaOH in its original package is melted in the oven 1, at a temperature of 300 to 400°C, before being introduced into the master tank 5, which is provided with a heater and in which the NaOH is maintained at a temperature of 380° before being transferred to the reactor 13 into which the waste coming from the cropper 14 is also introduced. After 30 minutes of immersion and with stirring at the start of obtaining a temperature of 350°C, the liquid is conducted by the line 19, provided with a pump, to the buffer tank 20 and then sent to the master tank 5. The buffer tank is heated to a temperature of 380°C in order to prevent heat shocks occurring in the tank 5. Moreover, the buffer tank is designed to gather the precipitates and is organized for the separation and extraction of the small particles. The decomposition products from the reactor 13 are transferred to the neutralization tank 23 and, at the end of the treatment, the residues are transported to the magnetic sorting device 32 where the metals are separated from the polymers resulting from the treatment.--.

Delete the second and third full paragraphs at page 6, lines 5-31, and insert therefor, the following:

--The master tank 5 is equipped with conventional monitoring and control instruments 8 to 11, known to those skilled in the art, which monitor the conditions in the tank and actuate the electronic control actuators when transfers are made and when other actions are taken. The regulatory safety valve 7 prevents unexpected and accidental overpressures and the heating element 6 (which may be placed on the

Delete the third paragraph, at page 8, line 15 - page 9, line 4, and insert therefor the following:

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microns. The solid particles are removed to a container 40 and will be able to be transferred thereafter to a washing tank external to the system with a filter press for the impurities precipitated by the neutralization and for recovering the materials to be recycled in a container of the 36 type. The 40% NaOH solution is recovered via the outlet 41. It will be put into drums and sold for another use or else introduced into the tank 24 in order to obtain a neutralizing agent and thus increase the profitability of the process.--.

Delete the third full paragraph, at page 9, lines 20-27, and insert therefor the following:

--During temporary shut-down or shut-down of short duration of the plant, the heating of the master tank 5 and possibly buffer tank must not be cut off. For a complete shut-down, it will be essential to drain, while hot, the buffer tank 20 to the master tank 5 and then via the line 43, connected to a battery of drums in which the solution will crystallize. To reuse the NaOH, the drums will be placed in the oven 1.--.

IN THE CLAIMS

Please cancel Claims 1 - 16 without prejudice or disclaimer, and add the following new Claims 17 - 31.

--17. (new) Process for treating vulcanized rubber waste, particularly tyres of all sizes and of all types and/or of other worn reinforced-rubber articles, such as boots, inflatable boats, this process comprising:

- coarse cutting of the said waste into fragments, and
- attacking said fragments using a molten pure base,

characterized in that said attacking of the fragments is carried out under temperature

conditions causing, in the presence of said attacking base, deconsolidation of the vulcanized rubber waste into deconsolidated solid fragments, and in that the process furthermore comprises

- separating said molten base from said deconsolidated solid fragments,
- neutralizing the deconsolidated solid fragments, and
- recycling or reutilizing the neutralized, deconsolidated solid fragments.

18. (new) Process according to Claim 17, characterized by the use of molten pure cast NaOH as the attacking liquid.

19. (new) Process according to Claim 17, characterized in that said separation comprises sedimentation of the deconsolidated fragments, separated beforehand from the molten base, in a settling and neutralizing liquid, and, after removal of the settling and neutralizing liquid, recovery of the deconsolidated fragments.

20. (new) Process according to Claim 17, characterized in that it comprises a recycling of the molten pure base.

21. (new) Process according to Claim 18, characterized in that the molten NaOH treatment temperature is at most 400°C, advantageously at most 350°C.

22. (new) Process according to Claim 17, characterized in that the deconsolidated solid fragments comprise metal fragments and fragments made of synthetic material and in that the process furthermore includes sorting between the metallic and synthetic deconsolidated fragments before they are recycled or reutilized.

27. (new) Plant according to Claim 25, characterized in that the neutralizing device comprises a tank provided with an inlet communicating with the outlet of the reactor, and with an outlet, the inlet and outlet being closeable, stirring equipment and a filter if necessary unclogged by the compressed-air device in the output line with extension, spraying equipment for facilitating the neutralization via a line.

28. (new) Plant according to Claim 25, characterized in that the neutralizing device comprises a tank for injection of neutralized liquid and for recovery.

29. (new) Plant according to Claim 25, characterized in that the neutralizing device comprises another tank which contains acid waste and is connected to a mixing unit in the line.

30. (new) Plant according to Claim 25, characterized in that it comprises devices for cleaning the precipitates and small particles, during treatment.

31. (new) Plant according to Claim 25, characterized in that the sorting device comprises a device for transporting the deconsolidated materials with magnetic separation of the metallic materials, possibly combined with an eddy-current system for the non-ferrous materials.

(Handwritten musical notation)

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Respectfully submitted,

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DOCKET NO.: 4006-007-30

MARKED-UP COPY OF PARAGRAPHS, AS AMENDED

Replacement for the first paragraph, at page 1, lines 3-9:

--The present invention relates to a process and a plant for the treatment of vulcanized rubber of all kinds, such as tyres, conveyor belts, boots, shoes and other objects containing assembled rubber and polymer materials for the purpose of recycling the [component [sic]] components by the relevant industries.--

Replacement for the fourth paragraph, at page 2, lines 25-32:

--GB 2,026,144 (1979) [of] discloses writing [[sic]] a plant for the treatment of rubber waste and of synthetic materials coming from worn tyres. Thermal decomposition of the product, which is coarsely reduced, is carried out in a fluidized bed of sand at 800°C in the presence of oxygen. The gases produced by the decomposition are used and, at the end of the process, the reinforcing metals are recovered by means of magnets.--

Replacement for the first full paragraph at page 4, lines 5-9:

--B) The reduced waste is introduced into a reactor and treated for 30 minutes at 350°C with an OH⁻ ion generator, preferably a strong alkaline base such as molten NaOH. 3. [[sic]] Separation of the basic liquid and the residues coming from the treated rubber.--;

Replacement for the first full paragraph at page 5, lines 8-27:

--As shown in Figure 1, crystallized NaOH in its original package is melted in the oven 1, at a temperature of 300 to 400°C, before being introduced into the master tank 5, which is provided with a heater and in which the NaOH is maintained at a temperature of 380° before being transferred to the reactor 13 into which the waste coming from the cropper 14 is also

introduced. After 30 minutes of immersion and with stirring at the start of obtaining a temperature of 350°C₂ [[sic]. The] the liquid is conducted by the line 19, [furnishes of [sic]] provided with a pump, to the buffer tank 20 and then sent to the master tank 5. The buffer tank is heated to a temperature of 380°C in order to prevent heat shocks occurring in the tank 5. Moreover, the buffer tank is designed to gather the precipitates and is organized for the separation and extraction of the small particles. The decomposition products from the reactor 13 are transferred to the neutralization tank 23 and, at the end of the treatment, the residues are transported to the magnetic sorting device 32 where the metals are separated from the polymers resulting from the treatment.--.

Replacement for second and third full paragraphs at page 6, lines 5-31:

--The master tank 5 is equipped with conventional monitoring and control instruments 8 to 11, known to those skilled in the art, which monitor the conditions in the tank and actuate the electronic control actuators when transfers are made and when other actions are taken. The regulatory safety valve 7 prevents unexpected and accidental overpressures and the heating element 6 (which may be placed [[sic]] on the outside, between the insulation, by heating coils conveying a warm liquid [lime]) keeps the temperature constant inside the tank.

The liquid is sent via the line 12, fitted with a pump, into the reactor 13 and the waste, cut up in the cropper 14, advantageously a guillotine, is sent by the chain conveyor 15 into the reactor 13, the solid materials must be immersed, the amount of caustic liquid is attained by the operation and control of a probe which also actuates the closure of the valve 17 and the start of the stirring provided by the mixer 16. The temperature of the reactor is maintained by the heating system 18. After approximately 30 minutes treatment at 350°C, the materials are deconsolidated, the caustic liquid is extracted by the line 19, fitted with a pump, through a filter 21, to the buffer tank 20. The filter 21 retains the particles greater than 1 mm. It is unclogged

suddenly by closing the valve of the line 19 and sending compressed air 44 into that part of the line [18] 19 [[sic]] which is connected to the tank 13.--.

Replacement for the third paragraph at page 8, line 15 - page 9, line 4:

--As this is a heat treatment, it is preferable to work continuously as long as possible. For this purpose, and in order to avoid shut downs due to the build-up of impurities and small particles, cleaning devices are provided for removing them, without having to stop the production. After a number of treatments and in anticipation of cleaning the buffer tank 20, the NaOH liquid in the master tank 5 will be taken to the minimum level in order to receive the entire solution stored in the buffer tank 20, up to the level of the tap on the line 21. Next, water will be slowly added via the line 37 to the rest of NaOH liquid, bottom of the buffer tank 20 for a direct dilution to the point of non-crystallization (concentration +/- 40%). After this dilution, the valve 38 is opened on a vibrating screen 39 having a porosity of 10 microns. The solid particles are removed to a container 40 and will be able to be transferred thereafter to a washing tank external to the system with a filter press for the impurities precipitated by the neutralization and for recovering the materials to be recycled in a [containers [sic]] container of the 36 type. The 40% NaOH solution is recovered via the outlet 41. It will be put into drums and sold for another use or else introduced into the tank 24 in order to obtain a neutralizing agent and thus increase the profitability of the process.--.

Replacement for the third full paragraph at page 9, lines 20-27:

--During temporary shut-down or shut-down of short [of] duration [[sic]] of the plant, the heating of the master tank 5 and possibly buffer tank must not be cut off. For a complete shut-down, it will be essential to drain, while hot, the buffer tank 20 to the master tank 5 and then via the line 43, connected to a battery of drums in which the solution will crystallize. To reuse the NaOH, the drums will be placed in the oven 1.--.

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PROCESS AND PLANT FOR SEPARATING THE CONSTITUENTS OF WORN
TYRES

5 The present invention relates to a process and a
plant for the treatment of vulcanized rubber of all kinds,
such as tyres, conveyor belts, boots, shoes and other
objects containing assembled rubber and polymer materials
for the purpose of recycling the component [sic] by the
relevant industries.

10 The bulk of these materials is represented above
all by the increase in road transport development which
gives rise to worrystome quantities of downgraded tyres
difficult to remove and possibly to recycle.

15 It should not be forgotten that more than 3
billion tyres, merely from private vehicles, are running
along the roads in the various countries and, of course,
have to be periodically replaced. In terms of weight, this
represents at least 18 million tonnes of bulky waste which
has to be disposed of, something which represents a
20 serious ecological problem difficult to solve, and above
all since people are becoming increasingly aware of
environmental problems and regulations.

A vast quantity of tyres is destroyed by
incineration and in cement kilns with recovery of thermal
25 energy. This approach is being increasingly questioned
because of the atmospheric pollution and of the
destruction of materials which are beneficial to recover.

Another process consists of successive grinding so
as to end up with small particles that can be used as
30 fillers in bitumens and asphalts. Such grinding has been
facilitated by cryogenic techniques. However, multiple
shredders, which are indispensable for shearing the metal
reinforcements, in order to produce reusable powder, are
heavy machines which devour energy and are consequently
35 very expensive.

Another destruction process, with recovery of certain components, is based on pyrolysis. The recycling consists in recovering the pyrolysis oil, the carbon and the metals. These processes are high-performance processes but they require the investment of large sums of money and high treatment costs, they are often the source of significant atmospheric pollution.

Thus efforts have been intensified to develop methods for stripping this bulky waste in a manner which is effective, economical and environmentally non-polluting. Considerable research has been focused on the problem, which obviously does not concern only worn tyres but all manufactured products made of rubber and also the waste accompanying the manufacture of these products, these often being reinforced with metal reinforcements or reinforcements made of synthetic materials. The ultimate problem does not reside only in the economical destruction of the rubber element or of the tyres, but it is also desirable to be able to recover and reuse them, or some of the components, for the purpose of avoiding unnecessary wastage of beneficial materials.

With the aim of illustrating the prior art in this field, it is appropriate to mention the following publications:

- GB 2,026,144 (1979) of writing [sic] a plant for the treatment of rubber waste and of synthetic materials coming from worn tyres. Thermal decomposition of the product, which is coarsely reduced, is carried out in a fluidized bed of sand at 800°C in the presence of oxygen. The gases produced by the decomposition are used and, at the end of the process, the reinforcing metals are recovered by means of magnets.

- US 4,426,459 (prior. JP 1980) discloses a process for the decomposition of vulcanized rubber by a treatment

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with cutters in a grating in order to obtain fragments 10 to 25 cm in length. The sole purpose of this is to reduce the size and thus facilitate handling during the treatment process.

- 5 B) The reduced waste is introduced into a reactor and treated for 30 minutes at 350°C with an OH⁻ ion generator, preferably a strong alkaline base such as molten NaOH. 3.[sic] Separation of the basic liquid and the residues coming from the treated rubber.
- 10 C) Neutralization of the residues with an acid, such as phosphoric acid;
- D) Recovery and separation of the rubber constituents and the metals used for reinforcement.

15 Destruction of some of the bonds between the rubber and the other reinforcing materials is achieved by the action of a strong alkaline base, such as molten NaOH which is maintained at a temperature of 350°C for approximately 30 minutes.

20 It is important to point out that the consumption of basic agent is very low and the etching liquid can be reused several times, by recovery and reinjection; the volume of the NaOH liquid product circulating will be automatically readjusted if necessary by a fresh addition of the product. Moreover, it should be emphasized that the
25 process according to the present invention does not involve any organic solvent. In addition, it works with waste which is only coarsely cut up and the substances serving for the proposed treatment are well known, commonly employed and inexpensive.

30 The plant for implementing the process is relatively simple and does not entail inordinate investment.

The details of the process according to the present invention will emerge from the description of the

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plant which relates thereto, the description being given by way of non-limiting example.

- Figure 1 shows schematically the overall plant;
- Figure 2 shows, on a larger scale, the first part of one of the possible embodiments of the plant;
- Figure 3 shows, on a larger scale, the second part of one of the possible embodiments of the plant.

As shown in Figure 1, crystallized NaOH in its original package is melted in the oven 1, at a temperature of 300 to 400°C, before being introduced into the master tank 5, which is provided with a heater and in which the NaOH is maintained at a temperature of 380°C before being transferred to the reactor 13 into which the waste coming from the cropper 14 is also introduced. After 30 minutes of immersion and with stirring at the start of obtaining a temperature of 350°C [sic]. The liquid is conducted by the line 19, furnishes of [sic] a pump, to the buffer tank 20 and then sent to the master tank 5. The buffer tank is heated to a temperature of 380°C in order to prevent heat shocks occurring in the tank 5. Moreover, the buffer tank is designed to gather the precipitates and is organized for the separation and extraction of the small particles. The decomposition products from the reactor 13 are transferred to the neutralization tank 23 and, at the end of the treatment, the residues are transported to the magnetic sorting device 32 where the metals are separated from the polymers resulting from the treatment.

According to this embodiment illustrated in greater detail in Figures 2 and 3, a drum 0 containing crystallized NaOH is introduced into the oven 1, which matches the shape of the drum, in which oven the NaOH is heated to a temperature of at least 380°C. The upper part and the straight vertical part of the oven form a cover which opens about the spindle 2 fastened to the bottom right of the oven in order to allow the drum to be easily

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loaded. A connection tube running to the pump 3 is introduced and connected to the bung of the drum.

The liquified NaOH is transferred to the master tank 5 in which it is maintained at 350°C.

5 The master tank 5 is equipped with conventional monitoring and control instruments 8 to 11, known to those skilled in the art, which monitor the conditions in the tank and actuate the electronic control actuators when transfers are made and when other actions are taken. The
10 regulatory safety valve 7 prevents unexpected and accidental overpressures and the heating element 6 (may be placed [sic] on the outside, between the insulation, by heating coils conveying a liquid lime) keeps the temperature constant inside the tank.

15 The liquid is sent via the line 12, fitted with a pump, into the reactor 13 and the waste, cut up in the cropper 14, advantageously a guillotine, is sent by the chain conveyor 15 into the reactor 13, the solid materials must be immersed, the amount of caustic liquid is attained
20 by the operation and control of a probe which also actuates the closure of the valve 17 and the start of the stirring provided by the mixer 16. The temperature of the reactor is maintained by the heating system 18. After approximately 30 minutes treatment at 350°C, the materials
25 are deconsolidated, the caustic liquid is extracted by the line 19, fitted with a pump, through a filter 21, to the buffer tank 20. The filter 21 retains the particles greater than 1 mm. It is unclogged suddenly by closing the valve of the line 19 and sending compressed air 44 into
30 that part of the line 18 [sic] which is connected to the tank 13.

 The buffer tank 20 is equipped with the same monitoring, control and heating apparatuses as the tank 5; it has a configuration which allows settling and reheating
35 of the caustic liquid to the temperature of 350°C in order

via the outlet 41. It will be put into drums and sold for another use or else introduced into the tank 24 in order to obtain a neutralizing agent and thus increase the profitability of the process.

5 Cleaning during production of the storage tank 24 is also provided. This tank having fed the neutralizing tank 23, the surplus neutral liquid will be withdrawn up to the level of the tap of the line 42 in order to be put on standby in the neutralizing tank 23. This will be
10 organized during the time for a treatment of the reactor 13 and for the neutralization which occupies the liquid. Provision shall be made for the tank 24 to be cleaned and for the liquid in the tank 23 to be returned to 24 during this reaction and neutralizing time

15 When the lower level corresponding to the tap of the outlet 42 is reached, the valve 43 opens and releases the particle-laden neutral liquid onto a vibrating screen identical to 39. The liquid is removed and the particles recovered.

20 During temporary shut-down or of short of duration [sic] of the plant, the heating of the master tank 5 and possibly buffer tank must not be cut off. For a complete shut-down, it will be essential to drain, while hot, the buffer tank 20 to the master tank 5 and then via the line
25 43, connected to a battery of drums in which the solution will crystallize. To reuse the NaOH, the drums will be placed in the oven 1.

 For the neutralization, the process makes use of acids, preferably phosphoric acids for the neutralization.
30 It is quite conceivable to use materials such as phosphoric acid solutions regarded as waste in the industry - this waste is available in large quantity. The process accepts various concentrations, even low concentrations, the adjustment is done automatically.
35 Consequently, the system may be regarded as a

- a device for the separation of metal
neutralized fragments and polymer.

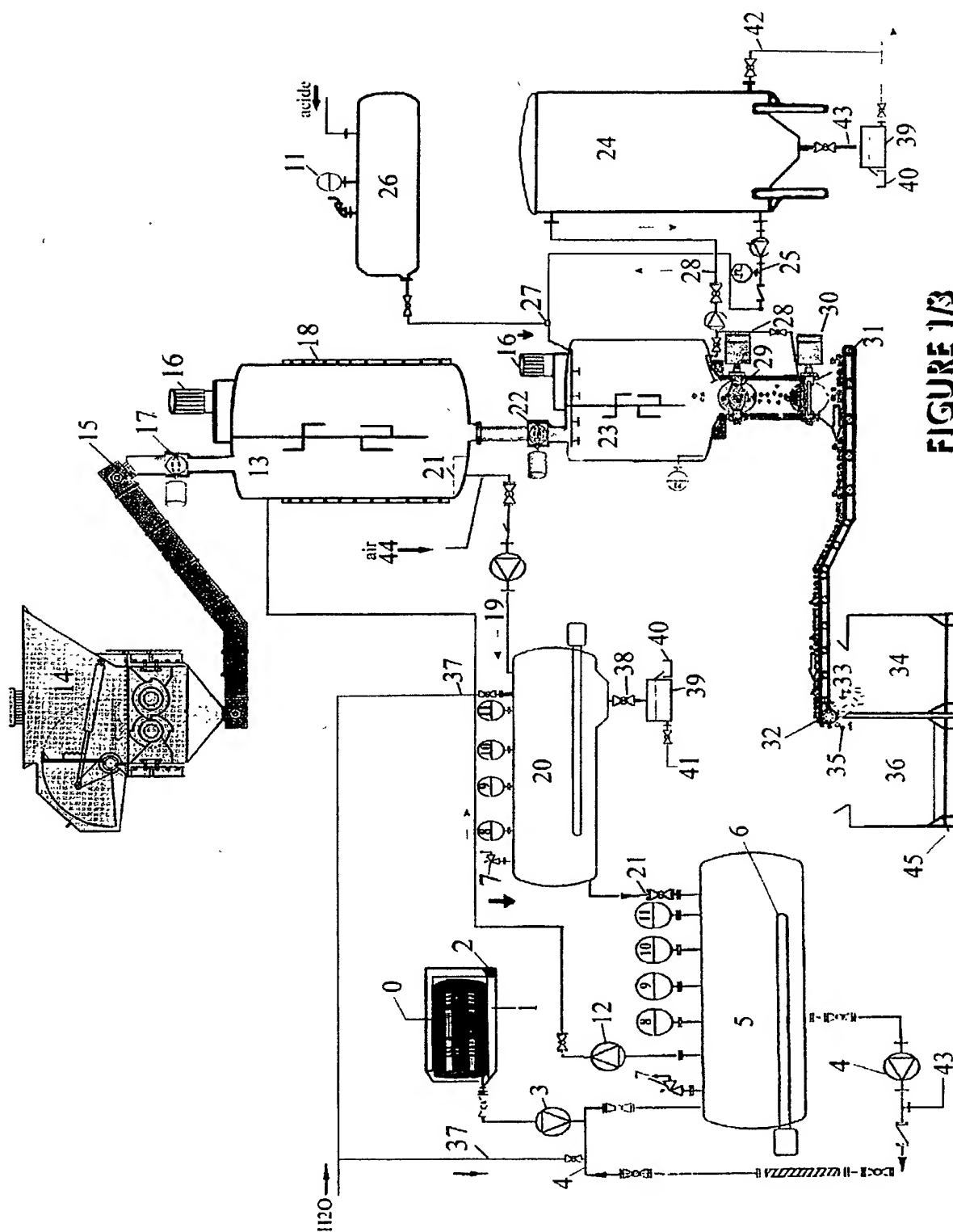
10. Plant according to Claim 9, characterized in that
the reactor (13) has closable inlet and outlet openings
5 (17 and 22), stirring equipment (16) and in that the
said separating device comprises a filter (21), if
necessary unclogged by the compressed-air device (44),
capable of retaining inside the reactor the particles
greater than 1 mm.
- 10 11. Plant according to either of Claims 9 and 10,
characterized in that the neutralizing device comprises
a tank (23) provided with an inlet communicating with
the outlet (22) of the reactor, and with an outlet, the
inlet and outlet being closeable, stirring equipment
15 (16) and a filter if necessary unclogged by the
compressed-air device in the output line with extension
(28), spraying equipment for facility the neutralizing
via the line (27).
12. Plant according to one or other Claim 9 to 11,
20 characterized in that the neutralizing device comprises
a tank (24) for injection of neutralized liquid and for
recovery via the lines (25 and 28).
13. Plant according to one or the other Claim 9 to 12,
characterized in that the neutralizing device comprises
25 another tank, source of financial returns by the use of
acid waste (26), connected to a mixing unit (27), on
the line (25).
14. Plant according to one of the other Claim 9 to 13,
characterized in that the devices for cleaning the
30 precipitates and small particles, during treatment, are
characterized by the equipment (38, 39, 40, 41, 42,
43).
15. Plant according to one or the other Claim 9 to 14,
characterized in that a device (31) for transporting

- 15 -

ABSTRACT

The invention concerns a method for treating tyres, belts, inflatable boats, boots and other manufactured articles containing rubber, polymers and reinforcing elements, which is a close circuit system consisting in immersing the waste materials to be treated in a hot alkaline hydroxide bath, followed by neutralization of the resulting materials with a weak mineral acid solution for industrial re-use of said materials.

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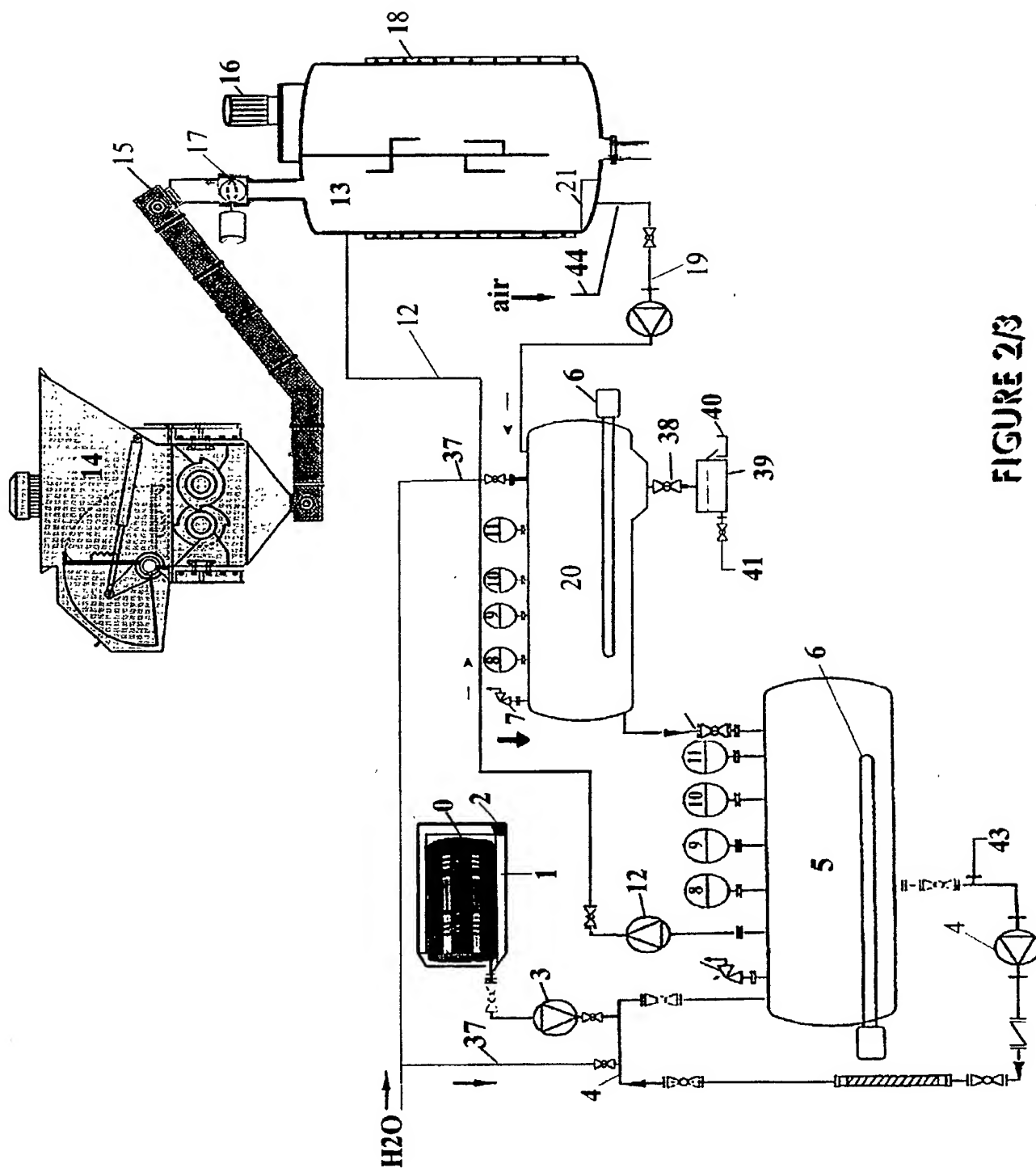
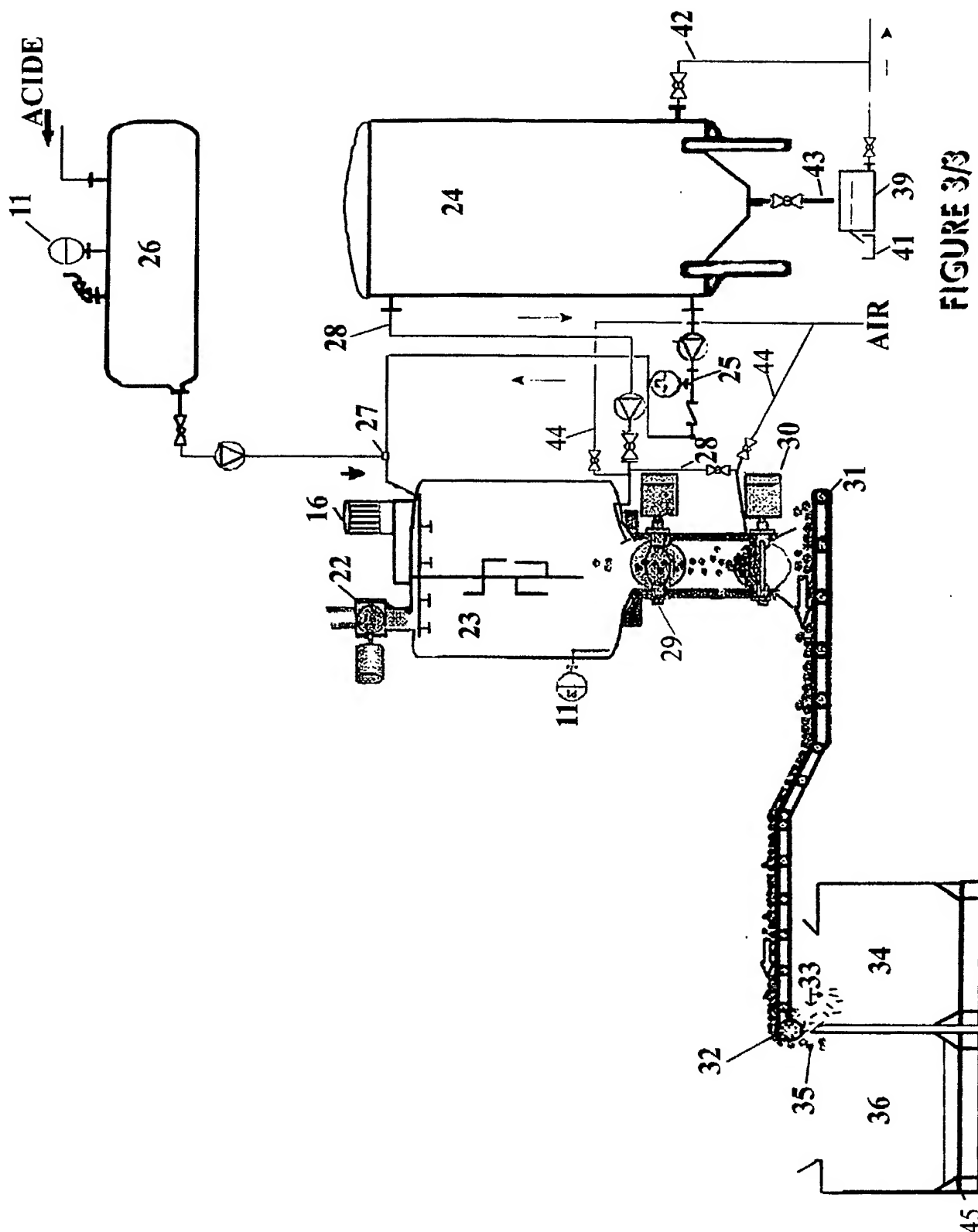


FIGURE 2/3

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**DECLARATION FOR UTILITY OR
DESIGN
PATENT APPLICATION
(37 CFR 1.63)**

☐ Declaration Submitted with Initial Filing OR ☒ Declaration Submitted after Initial Filing (surcharge (37 CFR 1.16 (e)) required)

Attorney Docket Number

First Named Inventor

DEBAILLEUL Gérard

COMPLETE IF KNOWN

Application Number

Filing Date

Group Art Unit

Examiner Name

As a below named inventor, I hereby declare that:

My residence, post office address, and citizenship are as stated below next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

Process and plant for separating the constituents of worn tyres

the specification of which

☐ is attached hereto OR

☒ was filed on (MM/DD/YYYY)

(Title of the Invention)

as United States Application Number or PCT International

Application Number **PCT/BE98/00180** and was amended on (MM/DD/YYYY) **11/20/1998** (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment specifically referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56.

I hereby claim foreign priority benefits under 35 U.S.C. 119(a)-(d) or 365(b) of any foreign application(s) for patent or inventor's certificate, or 365(a) of any PCT international application which designated at least one country other than the United States of America, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or of any PCT international application having a filing date before that of the application on which priority is claimed.

Prior Foreign Application Number(s)	Country	Foreign Filing Date (MM/DD/YYYY)	Priority Not Claimed	Certified Copy Attached?	
				YES	NO
9700933	Belgium	11/20/1997	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>	<input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/> <input type="checkbox"/>

☐ Additional foreign application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto:

I hereby claim the benefit under 35 U.S.C. 119(e) of any United States provisional application(s) listed below.

Application Number(s)	Filing Date (MM/DD/YYYY)	<input type="checkbox"/> Additional provisional application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

[illegible]

I hereby claim the benefit under 35 U.S.C. 120 of any United States application(s), or 365(c) of any PCT International application designating the United States of America, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. 112, I acknowledge the duty to disclose information which is material to patentability as defined in 37 CFR 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application.

U.S. Parent Application or PCT Parent Number	Parent Filing Date (MM/DD/YYYY)	Parent Patent Number (if applicable)

☐ Additional U.S. or PCT International application numbers are listed on a supplemental priority data sheet PTO/SB/02B attached hereto.

As a named inventor, I hereby appoint the following registered practitioner(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith: ☐ Customer Number → Place Customer

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Number Bar Code
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Registered practitioners(s) name/registration number listed below			
Name	Registration Number	Name	Registration Number
Jerold I. Schneider	<u>24,765</u>		

☐ Additional registered practitioner(s) named on supplemental Registered Practitioner Information sheet PTO/SB/02C attached hereto.

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I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under 18 U.S.C. 1001 and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Name of Sole or First Inventor: ☐ A petition has been filed for this unsigned inventor

☐ A petition has been filed for this unsigned inventor

Given Name (first and middle (if any))				Family Name or Surname			
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Post Office Address							
City	Schepdaal	State		ZIP	1703	Country	Belgium

☐ Additional insurance can be added on the unemployment Additional Insurance(s) check(s) DTG/CS/278 attached here.

- Supplemental Additional Immigrant check(s) DTC/SB/DA attached herein